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EVALUATION OF GEOTHERMAL POTENTIAL OR RANGE BRAVO 20, NAVAL AIR--ETC(U)
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LEVEL II

Evaluation of Geothermal Potential of Range Bravo 20, Naval Air Station, Fallon

by

James A. Whelan
Geothermal Utilization Division
Public Works Department

APRIL 1980

NAVAL WEAPONS CENTER
CHINA LAKE, CALIFORNIA 93555

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Naval Weapons Center
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FOREWORD

This is the final report of a study conducted by the Naval Weapons Center's Geothermal Utilization Division. The work was performed during fiscal year 1979 and was sponsored by the Naval Civil Engineering Laboratory, under Project No. Z0840-SL.

This study is part of an effort to determine the geothermal potential of Navy lands throughout the world. In this report the potential of Range Bravo 20, Naval Air Station, Fallon, Nev., was studied.

This report was reviewed for technical accuracy by Carl F. Austin.

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(U) *Evaluation of Geothermal Potential of Range Bravo 20, Naval Air Station, Fallon*, by James A. Whelan. China Lake, Calif., Naval Weapons Center, April 1980. 12 pp. (NWC TP 6149, publication UNCLASSIFIED.)

(U) As part of a task to determine the geothermal potential of Navy lands throughout the world, Range Bravo 20, at the Naval Air Station, Fallon, Nev., was evaluated.

~~(U)~~ Gravity, aeromagnetics, and temperature studies were made and it was concluded that deep drilling would be necessary to produce fluids of a temperature suitable for space heating. Therefore, additional studies of Range Bravo 20 should place emphasis on the west and southwest portions of the base.

(U) Incomplete studies indicate anomalous content of mercury in soils of the southwest portion of the range.

CONTENTS

INTRODUCTION

It is important for the Navy to determine the geothermal potential of its lands to prevent or minimize encroachment, and to develop energy self-sufficiency if the resources warrant. Consequently, the Geothermal Utilization Division, Public Works Department, Naval Weapons Center has been assigned the task of evaluating the geothermal potential of naval installations throughout the world.

As part of this task, the geothermal potential of Range Bravo 20, Naval Air Station (NAS), Fallon, Nev., was evaluated. Results of this evaluation are given in this report.

LOCATION AND ACCESSIBILITY

Range Bravo 20, NAS, Fallon (Figure 1), is located in the northeastern portion of Carson Sink in the northeastern portion of T23N R32E. The Navy desires to expand the range to include the entire township, as well as the southern half of T24N R32E. The Navy land is checkerboarded, with the Southern Pacific Land Company owning the odd-numbered sections. Geothermal leases have been granted on federal lands on all sides of the proposed expanded range.

Access to Range Bravo 20 is by an unimproved road that runs along the front of the Stillwater Mountain Range on the east side of Carson Sink and across the alkali flats, or from an unimproved road that leaves U.S. Highway 95 about 27 miles north of Fallon and runs along the east side of the West Humboldt Range and across the alkali flats.

The climate of the area is arid, and precipitation averages about 5.1 inches per year. From November through April precipitation is frequently in the form of snow. Temperature extremes range from 105°F in July to -14°F in December; the mean temperature is 47°F.

The range is shown on Army Map Service (AMS) Reno Sheet NJ 11-1, and on the Lone Rock, Lone Rock SE, Lone Rock SW, and Lone Rock NW 7-1/2 minute quadrangle maps.

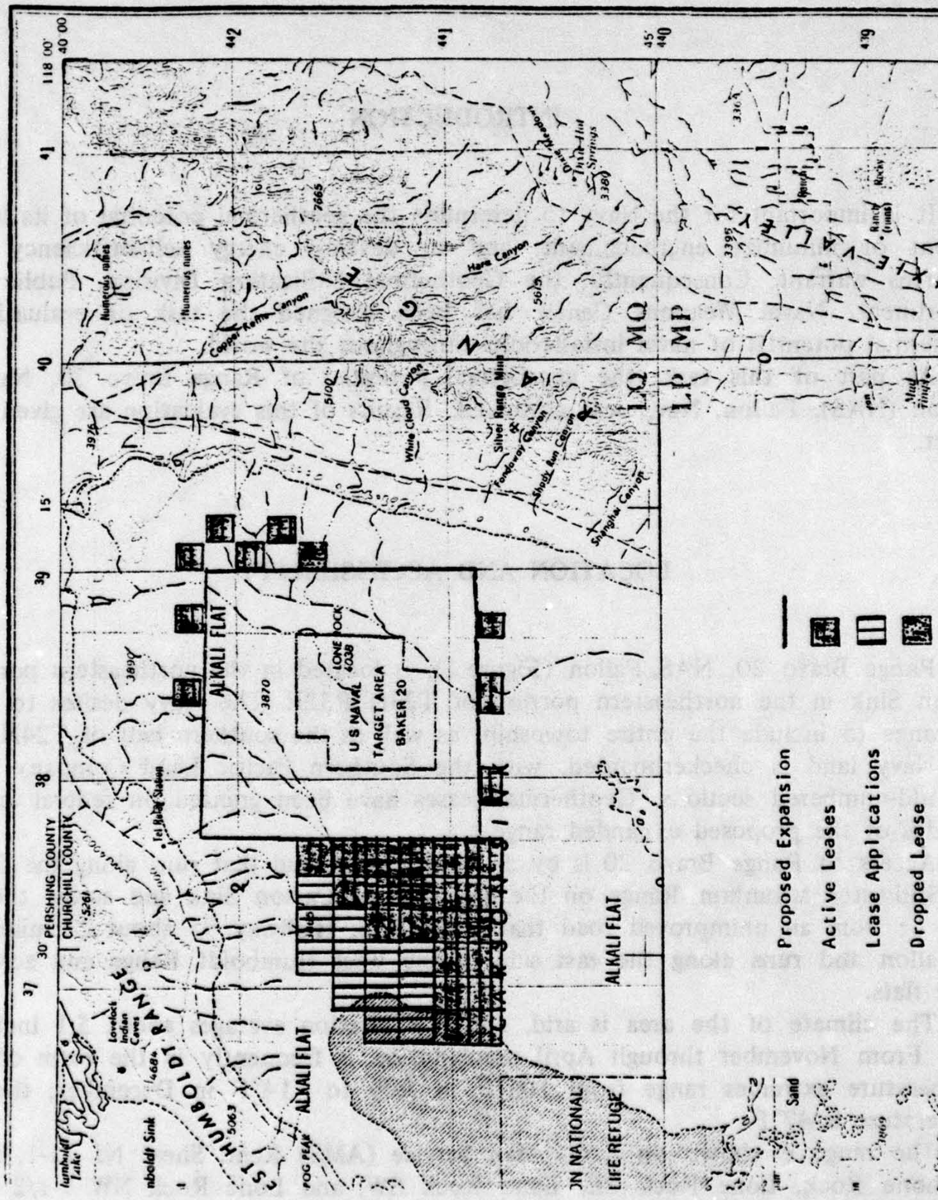

FIGURE 1. Location of Range Bravo 20, NAS, Fallon (Summer 1978).

GEOLOGY

Range Bravo 20 is located on the alkali flat portions of Carson Sink. Prior geologic studies include those of Russell, Morrison, Wilden and Speed, and Garside and Schilling.[1-4]

Carson Sink is located in an area once covered by a Pleistocene glacial lake (Lake Lahontan). Isreal C. Russell's classic study of Lake Lahontan made between 1881 and 1883 was published as U.S. Geological Survey Monograph 11.[1] This study was updated by Morrison.[2] Russell's interpretation of lake history was generally correct; however, Morrison's detailed mapping and stratigraphy provide a useful base for studies in the area.

Wilden and Speed provide excellent data on the economic geology of the area.[3] Their discussion of geothermal potential is limited, however, due to the large area they covered, the commodities and mines they had to describe, and the low level of geothermal exploration at that time (because, although the Geothermal Steam Act of 1970 had been passed, leasing had not been implemented yet). Garside and Schilling state that a 3758-foot-deep wildcat oil well that flowed hot water was reported in Section 15, T22N, R30E (MDB&M) approximately 6 miles south and 12 miles east of Range Bravo 20.*

A description of the surficial deposits of Carson Sink as given by Morrison is as follows:[2]

"Carson Sink is nearly level, varying less than 10 feet in altitude in 20 miles across its central part; it is commonly heavily salt encrusted and is completely barren except at the mouths of the Carson and Humboldt Rivers, where patches of saltgrass are watered by intermittent overflow. On the west, north, and east the sink lies close to the piedmont slopes of the bordering mountains, but on the south and southwest 12 to 34 miles of lowlands intervene. Although the local relief is small, the lowlands are rough in detail and have a topography peculiar to areas of strong wind action."

* Oral communication of Ron Forrest, L. J. Garside, and J. H. Schilling, 1974.

1 U.S. Geological Survey. *Geological History of Lake Lahontan, a Quaternary Lake of Northwestern Nevada*, by I. D. Russell. Washington, D.C., 1885. (U.S. Geological Survey Monograph 11, UNCLASSIFIED.)

2 U.S. Geological Survey. *Lake Lahontan: Geology of Southern Carson Desert, Nevada*, by R. B. Morrison. Washington, D.C., 1964. (U.S. Geological Survey Professional Paper 401, UNCLASSIFIED.)

3 Nevada Bureau of Mines. *Geology and Mineral Deposits of Churchill County, Nevada*, by R. Wilden and R. C. Speed. Reno, Nev., University of Nevada, 1974. (Nevada Bureau of Mines Geology Bulletin 83, UNCLASSIFIED.)

4 Nevada Bureau of Mines. *Thermal Waters of Nevada*, by L. J. Garside and J. H. Schilling. Reno, Nev., University of Nevada, 1979. (Nevada Bureau of Mines Geology Bulletin 91, UNCLASSIFIED.)

A small outlayer of quaternary basalt (Lone Rock) is the only rock outcropping. Subsurface data are based on the Well Standard of California (Southern Pacific Land Company Hole 1), Center NW 1/4, Sec 23, T24N, R33E. This is an 11,000-foot hole. Pleistocene sediments were present to 3000 feet, with Paleocene sediments to the bottom. The hole was stopped when Oligocene tuffs were encountered.*

GEOPHYSICS

TEMPERATURE DATA

Limited poor-quality temperature data were obtained from the Well Standard of California (Southern Pacific Land Company Hole 1). These data, available from the Nevada Bureau of Mines and Geology, are:

Date, 1974	Depth, ft	Temperature, °F	Notes
7/25	875	108	2 hours after circulation
7/31	3080	124	3.5 hours after circulation
9/5	8188	205	5 hours after circulation
9/8	8104-8208	248	Drill stem test 1
10/2	10810-11000	275-285	Drill stem test 2
10/3	4708-4735	154	Drill stem test 3
10/5	3076-3708	129-144	Drill stem test 4
10/6 & 7	3076-3078	129-130	Drill stem test 5
10/7 & 8	3076-3078	126-155	Drill stem test 6
10/9	3020-3050	118-155	Drill stem test 7

These data are plotted in Figure 2. An equilibrium curve based on exponential growth curves was also plotted using mean temperatures. The equilibrium bottom hole temperature was calculated to be 288°F. This gives an average gradient of:

$$\frac{T}{D} = \frac{(299 - 47) \times 100}{11000} = 2.3°F/100 \text{ ft or } 4.2°C/100 \text{ m}$$

This is a low gradient.

* Author's personal communication with J. H. Schilling, Nevada Bureau of Mines, 16 *February 1979.*

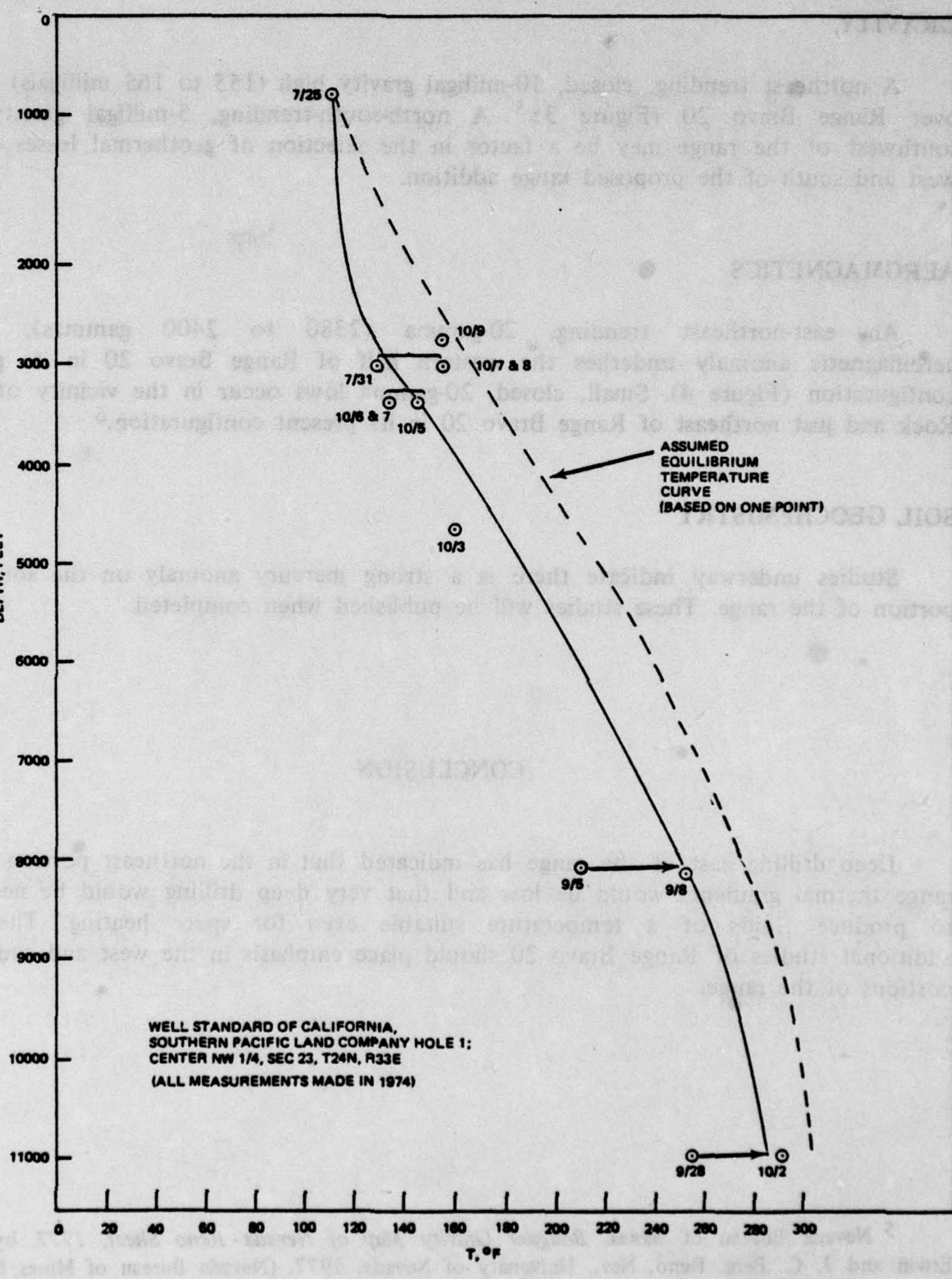

FIGURE 2. Measured Temperatures and Calculated Equilibrium Temperatures, Carson Sink, Nevada.

GRAVITY

A northeast trending, closed, 10-milligal gravity high (155 to 165 milligals) occurs over Range Bravo 20 (Figure 3).[5] A north-south-trending, 5-milligal gravity low southwest of the range may be a factor in the selection of geothermal leases to the west and south of the proposed range addition.

AEROMAGNETICS

An east-northeast trending, 20-gamma (2380 to 2400 gammas), closed aeromagnetic anomaly underlies the western half of Range Bravo 20 in its present configuration (Figure 4). Small, closed, 20-gamma lows occur in the vicinity of Lone Rock and just northeast of Range Bravo 20 in its present configuration.[6]

SOIL GEOCHEMISTRY

Studies underway indicate there is a strong mercury anomaly on the southwest portion of the range. These studies will be published when completed.

CONCLUSION

Deep drilling east of the range has indicated that in the northeast portion of the range thermal gradients would be low and that very deep drilling would be necessary to produce fluids of a temperature suitable even for space heating. Therefore, additional studies of Range Bravo 20 should place emphasis in the west and southwest portions of the range.

[5] Nevada Bureau of Mines. *Bouguer Gravity Map of Nevada - Reno Sheet, 1977*, by J. W. Erwin and J. C. Berg. Reno, Nev., University of Nevada, 1977. (Nevada Bureau of Mines Map 58, UNCLASSIFIED.)

[6] Nevada Bureau of Mines. *Aeromagnetic Map of Nevada, Reno Sheet*. Reno, Nev., University of Nevada, 1977. (Nevada Bureau of Mines, Map 54, UNCLASSIFIED.)

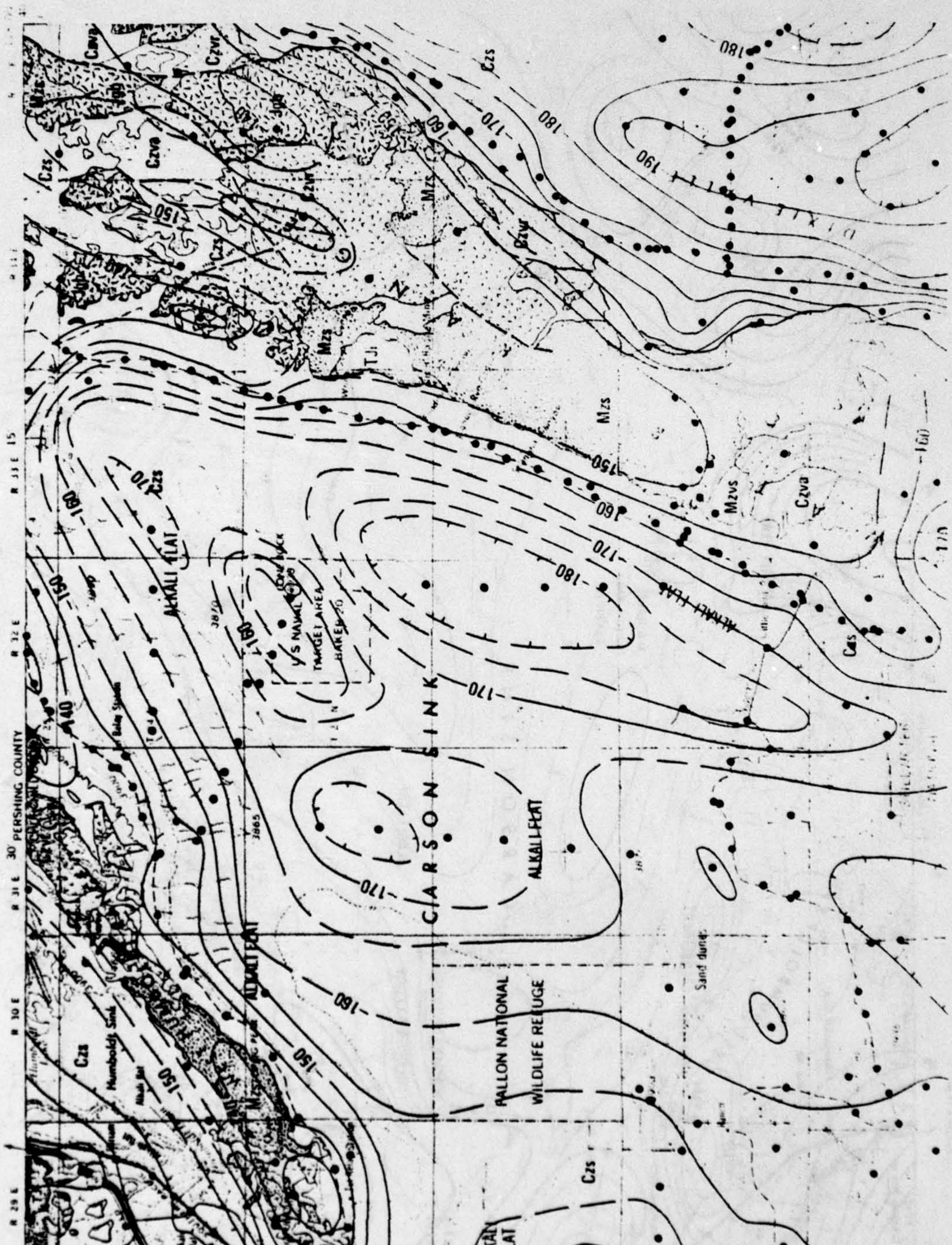

FIGURE 3. Bouguer Gravity Map, Range Bravo 20 and Vicinity, NAS Fallon.

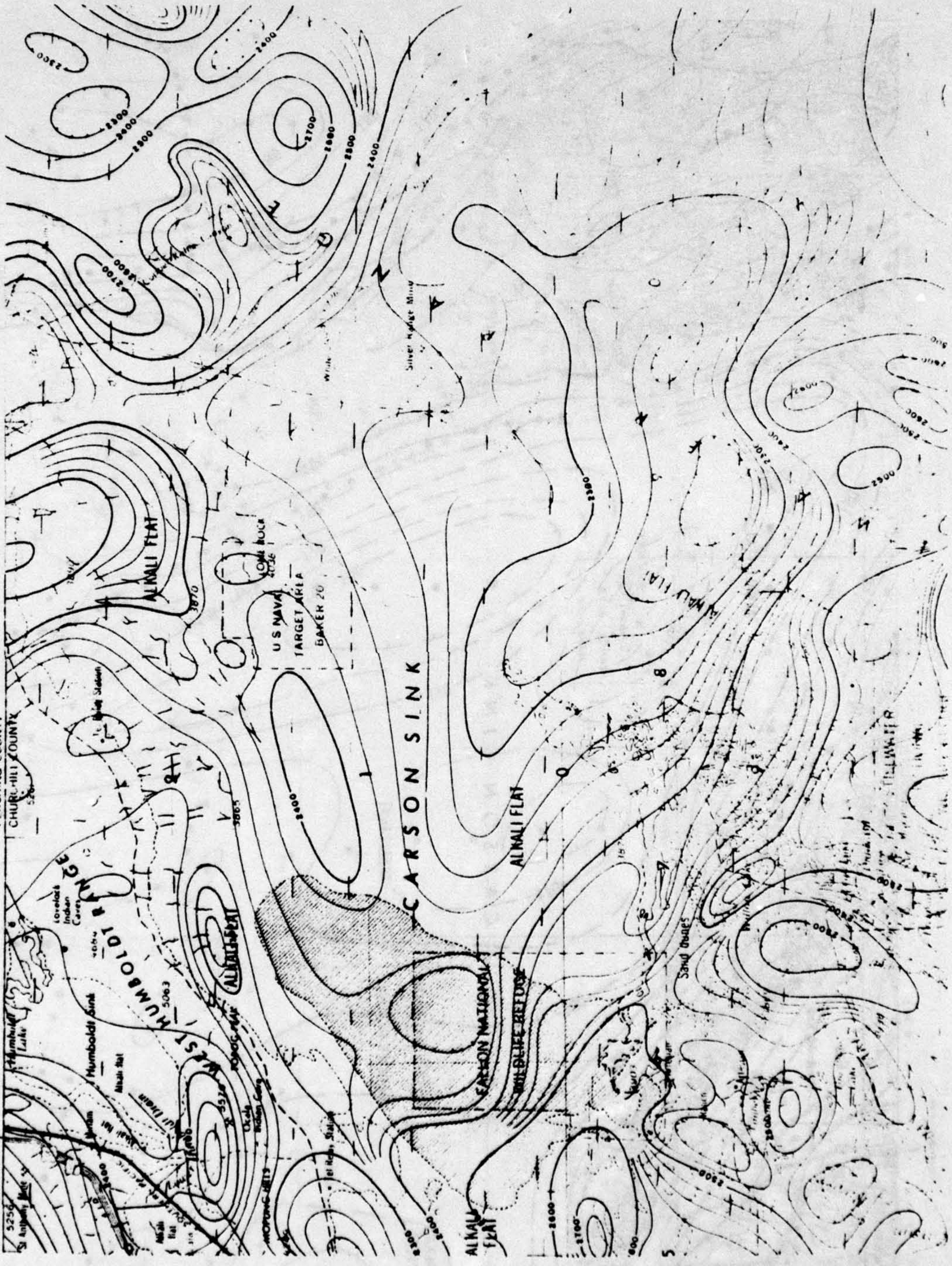

FIGURE 4. Aeromagnetic Map, Range Bravo 20, NAS Fallon.

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